WWU MÜNSTER

Aktuelle Fragen
der Nanophysik

Donnerstag, 05.12.2019 um 17:30 Uhr
Ort: Seminarraum 87, Wilhelm Klemm-Straße 10

(Photo)catalytic properties of pristine and defected MoS_2

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MoS_2 is a fascinating two-dimensional van der Waals material with outstanding electronic, optical and catalytic properties. Its high optical absorption up to 15% in the visible range for monolayers together with catalytic activity and photocatalytic stability make single-layer MoS_2 a very promising material for sunlight driven photocatalytic applications such as photocatalytic hydrogen evolution (HER) [1,2,3].
We study the (photo)catalytic activity regarding HER of exfoliated single- and few-layer MoS_2 immersed in an acid electrolyte by cyclic voltammetry [4]. We observe an increased catalytic activity of MoS_2 with decreasing number of layers. In particular, monolayers exhibit high current densities, low onset potentials and high turnover frequencies. Furthermore, it is vital to understand which surface sites are highly active in order to maximize their number and to improve the overall (photo-)catalytic behavior of those materials. Here, we visualize in-situ the catalytically active sites at the surface of mechanically exfoliated MoS_2 with lateral resolution on the nanometer scale by means of electrochemical scanning tunneling microscopy [5]. The edges of single MoS_2 flakes show high catalytic activity, whereas their surfaces are inactive. We demonstrate that the inert basal plane of these materials can be activated towards the HER with the help of a focused beam of a helium ion microscope.

[1] U. Wurstbauer *et al.* J. Phys. D: Appl. Phys. **50**, 173001 (2017).
[2] S. Funke, *et al.*, J. Phys.: Condens. Mat. **28**, 385301 (2016).
[3] E. Parzinger, *et al.*, ACS Nano, **9(11)**, 11302 (2015).
[4] E. Parzinger, E. Mitterreiter *et al.* App. Mat. Today, **8**, 132-140 (2017).
[5] E. Mitterreiter *et al.* npj 2D Mat. and Appl. **3**, 25 (2019).

Im Anschluss wissenschaftlicher Austausch bei vorweihnachtlichem Glühwein
Bitte Tassen mitbringen, Plätzchen-Spenden sind herzlich willkommen!